



Occurrence and distribution of *Pseudoscalibregma* and *Scalibregma* (Annelida, Scalibregmatidae) in the deep Nordic Seas, with the description of *Scalibregma hansenii* n. sp.

TORKILD BAKKEN^{1,4}, EIVIND OUG² & JON ANDERS KONGSRUD³

¹Norwegian University of Science and Technology, University Museum, NO-7491 Trondheim, Norway

²Norwegian Institute for Water Research, Regional Office Sørlandet, Jon Lilletuns vei 3, NO-4879 Grimstad, Norway

³Natural History Collections, University Museum of Bergen, University of Bergen, P.O. Box 7800, NO-5020 Bergen, Norway

⁴Corresponding author. E-mail: torkild.bakken@ntnu.no

Abstract

Until recent years, only a few scalibregmatid species have been known from the Nordic Seas, largely from shelf and coastal waters. Access to a large collection from deep areas has made it possible to provide more knowledge on the diversity of this group in the area. *Pseudoscalibregma parvum* (Hansen, 1879) is here redescribed. The species has a wide geographic distribution in the Nordic Seas, the Barents Sea, and the Kara Sea. Type specimens of *Eumenia longisetosa* Théel, 1879 were found to be similar to specimens of *P. parvum*, confirming the synonymy of the species. A new species, *Scalibregma hansenii* n. sp., is described from specimens found on the continental slope. It is particularly characterised by having three pairs of rather simple branchiae. Both *P. parvum* and *S. hansenii* have small spines in the most anterior chaetiger(s), resembling spines reported from a few other *Pseudoscalibregma* and *Scalibregma* species and supporting the need to emend the genus diagnosis of *Pseudoscalibregma*. *Scalibregma abyssorum* Hansen, 1879 was reassessed and considered to be a *nomen dubium*. *Scalibregma inflatum*, which has a wide distribution along the Norwegian coast and continental shelf, is found to be restricted to depths above about 900 m. Depths from 600–800 m on the continental slope represent a transition zone with fluctuations between temperate North Atlantic water (about 7°C) and cold Norwegian Sea water (below 0°C). The three species coexist in this zone, whereas *P. parvum* and *S. hansenii* n. sp. extend down to 1700 and 1200 m, respectively, on the slope at temperatures below 0°C.

Key words: Polychaeta, Norwegian Sea, MAREANO, deep sea

Introduction

The scalibregmatids are a group of polychaetes with relatively few described species, in total about 50 (Blake 2000). A number of the known species have been described from the deep sea. The Norwegian scalibregmatids were treated by Støp-Bowitz (1945, 1948). He reported three species, viz. *Scalibregma inflatum*, *Pseudoscalibregma parvum* and *Polyphysia crassa*, based on examination of museum specimens collected over more than a century. *Scalibregma inflatum* and *Polyphysia crassa* were reported from numerous finds along the Norwegian coast, whereas *Pseudoscalibregma parvum* was recorded from a few deep sites on the Norwegian shelf and in Arctic waters. No more species were reported until recent years, when species of *Asclerocheilus* and *Axiokebuitta* were found (Oug 2000; Persson & Pleijel 2005).

Recent access to new samples from shelf, offshore slope, and deep-water areas has provided even more species of scalibregmatids. In this study, new information on *Scalibregma* and *Pseudoscalibregma* from deeper parts of the Nordic Seas is presented, including the description of a new species of *Scalibregma* from offshore deep water. *Pseudoscalibregma parvum* appears to be the most abundant scalibregmatid in deep waters. Based on the examination of type material and a large number of newly collected specimens, a redescription of *P. parvum* is provided.

The first described scalibregmatid was *Scalibregma inflatum* Rathke, 1843 from Molde, western Norway. This

species has been reported from world-wide areas, although a cosmopolitan distribution has been questioned (Blake 1981; Kudenov & Blake 1978). Mackie (1991) redescribed the species and clarified the status of several characters of taxonomic importance. He indicated a far more restricted distribution and pointed out that several reports from the Northeast Atlantic may relate to other species as well. *Pseudoscalibregma parvum* (Hansen, 1879) was described based on material from the Norwegian North Atlantic Expedition 1876–78. This species has been reported from the North Atlantic and several Arctic areas (Hartman 1965; Jirkov 2001; Støp-Bowitz 1948). *Eumenia longisetosa* Théel, 1879 was described from the Kara Sea, in the same general area, and was later synonymised with *P. parvum* (e.g., Ashworth 1901; Furreg 1925; Støp-Bowitz 1945). In this study, the original material of *E. longisetosa* has been re-assessed as part of the redescription of *P. parvum*.

Material and methods

Most of the material for this study was sampled in the Norwegian Sea in 1980–1987 using epibenthic sledges, specifically a D-sledge, which is a predecessor of the "Snelli-sledge" (Snelli 1998), and an RP-sledge (Brattegard & Fosså 1991). In addition, material collected by the Centre for Geobiology, University of Bergen (CGB) by use of RP-sledge and by the MAREANO programme by use of box-corer, grab, beam trawl, and RP-sledge was made available for study.

Images were made using a Leica M205C stereo microscope, mainly for digital photos of specimens. Leica LAS software was used to take compound images with the "Z-stack" option. SEM images were taken using a ZEISS Supra 55VP microscope at the Laboratory for Electron Microscopy, University of Bergen.

Specimens used in this study are deposited at the collections of the University Museum of Bergen, University of Bergen (ZMBN) and the University Museum, Norwegian University of Science and Technology, Trondheim (NTNU-VM). The type material of *Eumenia longisetosa* was borrowed from the Swedish Museum of Natural History, Stockholm (SMNH).

Results

Pseudoscalibregma Ashworth, 1901

Pseudoscalibregma Ashworth, 1901: 296.

Type species: *Scalibregma parvum* Hansen, 1879

Diagnosis (emended). Body elongate, posterior part tapering ('arenicoliform'). Prostomium T-shaped with distinct lateral processes. Posterior parapodia with dorsal and ventral cirri. Branchiae absent. Large acicular spines absent; small thin, pointed or bifurcate spines present in chaetiger 1.

Remarks. The diagnosis for the genus follows Blake (1981), with the exception of details concerning the presence of small spines in the first chaetiger as observed in the recently described species, *P. orientalis* from Japan (Imajima 2009) and in the type species *P. parvum* (present study, see below). The spines are similar to the thin spines in chaetigers 1–2 in species of *Scalibregma* that may be blunt or bifurcate. The spines are believed to be homologues of the furcate setae found in more posterior chaetigers (Mackie 1991).

Pseudoscalibregma parvum (Hansen, 1879)

Figures 1–3

Scalibregma parvum Hansen, 1879: 7–8, pl. V, figs 7–14.—1882: 35–36.

Eumenia longisetosa Théel, 1879: 49–51, pl. III, figs 45–47, pl. IV, fig. 48.

Pseudoscalibregma longisetosum.—Furreg 1925: 170–176, figs S–X.

Pseudoscalibregma parvum.—Ashworth 1901: 296.—Støp-Bowitz 1945: 72–75, fig. 3.—1948: 27–29, fig. 9.—Jirkov 2001: 368.—Bakken *et al.* 2010: 12.

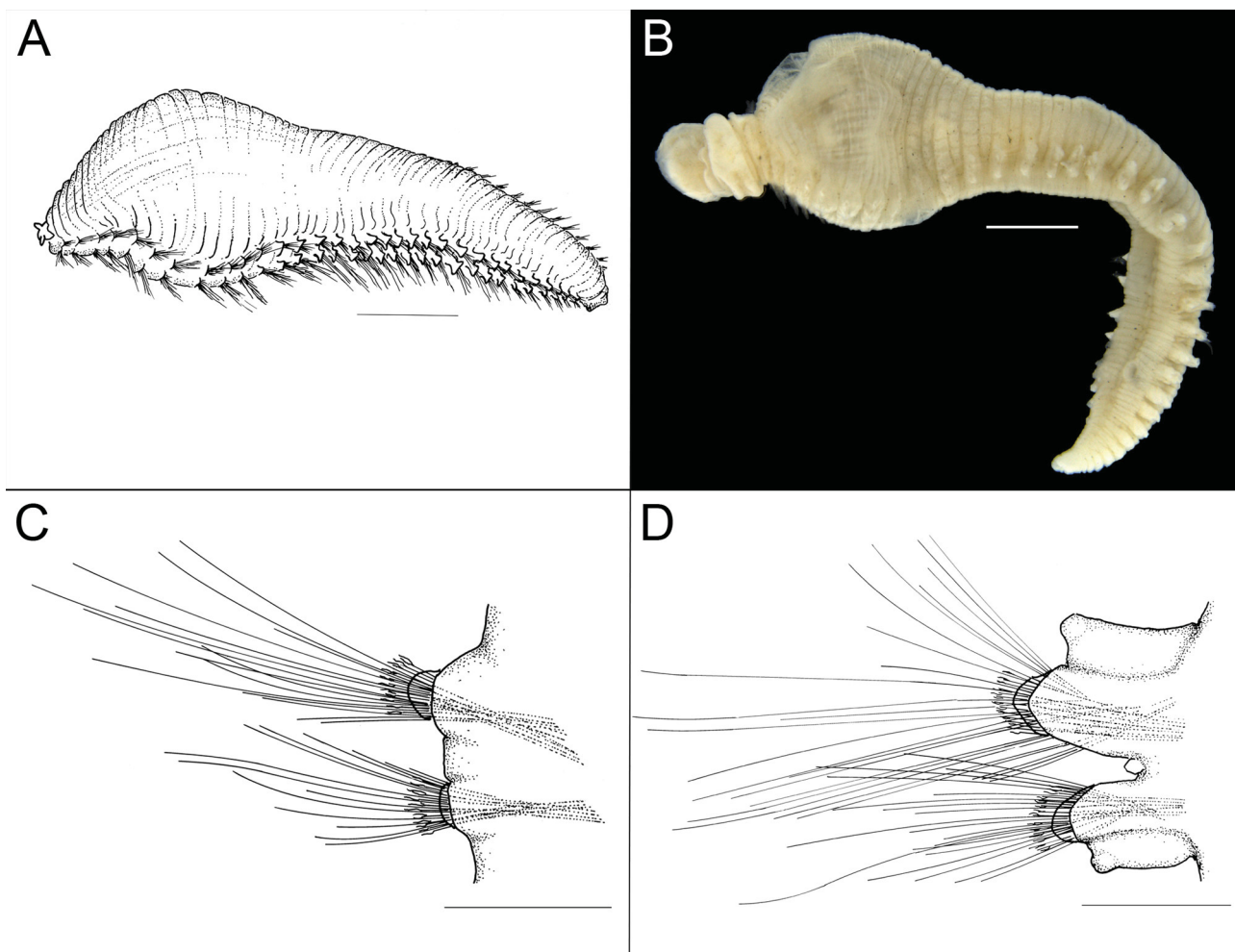


FIGURE 1. *Pseudoscalibregma parvum*. A. Complete specimen, dorso-lateral view. B. Photo of lectotype, with proboscis everted. C. Left parapodium from chaetiger 9, posterior view. D. Left parapodium from chaetiger 20, posterior view. B from ZMBN 94015. A, C–D Specimen from close to type locality Sta. OL-11. Scale bars: A–B: 2 mm, C–D 0.5 mm.

Type locality. The Norwegian Sea, off the coast of western Norway at 63°10'N 4°0'E, 763 m, The Norwegian North-Atlantic Expedition Sta. 31 (lectotype designated here).

Type material. *Pseudoscalibregma parvum*: Lectotype (ZMBN 94015) and 3 paralectotypes (ZMBN 2275). Paralectotypes from two different localities, Norwegian North-Atlantic Expedition Sta. 31 (type locality) and Sta. 18, 62°44'N 1°48'E, 753 m (see “Remarks” for details). *Eumenia longisetosa* Theel, 1879 (all syntypes): SMNH-118416, 4 spms, Kara Sea, Russia, 5 Aug 1875, 20 m, sand, No 150, 70°40'N 64°17'E, Leg N. Semlja Exp. 1875; SMNH-118413, 5 spms, Kara Sea, Russia, 3 Aug 1875, NE of Jugar Scharr, 218 m, clay, Leg N. Semlja Exp. 1875; SMNH-118411, 5 spms, Kara Sea, Russia, No 147, 164 m, mud, 71°05'N 61°20'E, Leg N. Semlja Exp. 1875; SMNH-118412, 3 spms, Kara Sea, Russia, 4 Aug 1875, No 147, 71°05'N 61°20'E, 164 m, clay, Leg N. Semlja Exp. 1875; SMNH-118414, 1 spm, Novaja Zemlja, Kara Sea, Russia, No 148, 4 Aug 1875, 127 m, 71°40'N 63°50'E, Leg N. Semlja Exp. 1875; SMNH-118415, 2 spms, Kara Sea, Russia, 31 Aug 1875, No 186, 109 m, 73°34'N 57°56'E, Leg N. Semlja Exp. 1875; SMNH-118409, 1 spm, Matoschkin Scharr, E of Rossman Station, Russia, No 12, 73–91 m, muddy stones, 4 Aug 1876, Leg Nordenskiolds Exp. 1876.

Other material. Swedish Arctic Expedition 1899: SMNH-126668, 9 spms, Hurry's Inlet, Scoresby Sound, eastern Greenland, No 33, 4 Aug 1899, 70°43'N 22°29'W, 70 m; SMNH-126665, 5 spms, eastern Greenland, No 18, 4 July, No 18, 4 July 1899, 74°55'N 17°59'W, 350 m, ooze, sand and pebbles; SMNH-126664, 4 spms, Jan Mayen, 24 June 1899, No 17, 71°12'N 08°28'W, 1275 m, grey clay; SMNH-126666, 11 spms, Cap Darry, eastern Greenland, 24 July 1899, No 25, 72°28'N 21°48'W, 180 m, mud with stones; SMNH-126667, 3 spms, about 1 km W of Murray's Inlet, eastern Greenland, 28 July 1899, No 28, 71°33'N 21°44'W, 200 m, mud with some stones. R/V ‘H. Mosby’ stations: Sta. 81.03.21.1, Lat: 63.166 Long: 04.816, 830 m, -0.9°C, 21 Mar. 1981, 12 spms; Sta.

81.03.22.1, Lat: 63.285 Long: 04.413, 1260 m, -0.9°C, 22 Mar. 1981, 8 spms; Sta. 81.06.04.4, Lat: 66.983 Long: 04.270, 1380 m, -0.9°C, 4 June 1981, 3 spms; Sta. 81.06.06.3, Lat: 65.686 Long: 05.633, 602 m, 0.3°C, 6 June 1981, 1 spm; Sta. 81.06.06.7, Lat: 65.716 Long: 05.238, 794 m, -0.9°C, 6 June 1981, 23 spms; Sta. 81.06.06.8, Lat: 65.666N Long: 04.815, 996 m, -1.0°C, 6 June 1981, 1 spm; Sta. 81.06.07.1, Lat: 65.696 Long: 04.381, 1211 m, -1.0°C, 7 June 1981, 1 spm; Sta. 81.08.13.2, Lat: 63.423 Long: 04.090, 1288 m, -0.9°C, 13 Aug. 1981, 5 spms; Sta. 81.08.15.5, Lat: 63.198 Long: 00.693, 1494 m, -0.9°C, 15 Aug. 1981, 2 spms; Sta. 81.08.15.6, Lat: 63.201 Long: 00.693, 1501 m, -1.0°C, 15 Aug. 1981, 1 spm; Sta. 81.08.16.3, Lat: 62.800 Long: 01.043, 1009, -1.0°C, 16 Aug. 1981, 5 spms; Sta. 81.08.16.7, Lat: 62.553 Long: 00.981, 800 m, -0.9°C, 16 Aug. 1981, 18 spms; Sta. 82.01.21.2, Lat: 62.491 Long: 01.721, 604 m, 1.1°C, 21 Jan. 1982, 6 spms; Sta. 82.01.21.4, Lat: 62.560 Long: 00.981, 804 m, -0.9°C, 21 Jan. 1982, 10 spms; Sta. 82.01.21.6, Lat: 62.803 Long: 01.088, 984 m, -0.9°C, 21 Jan. 1982, 2 spms; Sta. 82.08.15.1, Lat: 63.048 Long: 00.808, 1286 m, -1.0°C, 15 Aug. 1982, 6 spms; Sta. 82.08.19.1, Lat: 66.626 Long: 02.515, 1626 m, -0.9°C, 19 Aug. 1982, 1 spm; Sta. 82.08.23.1, Lat: 63.213 Long: 03.121, 1003 m, -1.0°C, 23 Aug. 1982, 12 spms; Sta. 82.11.26.1, Lat: 63.178 Long: 02.765, 1030 m, -1.0°C, 26 Nov. 1982, 8 spms; Sta. 82.11.27.1, Lat: 62.985 Long: 03.218, 804 m, -1.0°C, 27 Nov. 1982, 20 spms; Sta. 83.06.02.1, Lat: 62.198 Long: -00.003, 708 m, -0.3°C, 2 June 1983, 4 spms; Sta. 83.06.03.1, Lat: 61.343 Long: -03.185, 1338 m, -0.7°C, 3 June 1983, 2 spms; Sta. 83.06.03.2, Lat: 60.201 Long: -06.625, 1220 m, -0.8°C, 3 June 1983, 1 spm; Sta. 83.06.07.2, Lat: 64.435 Long: -11.170, 400 m, -0.2°C, 7 June 1983, 1 spm; Sta. 83.06.08.1, Lat: 65.168 Long: -09.493, 784 m, -0.6°C, 2 spms; Sta. 83.06.08.2, Lat: 65.460 Long: -07.588, 1626 m, -0.9°C, 8 June 1983, 7 spms; Sta. 83.06.17.3, Lat: 62.593 Long: 01.233, 781 m, -0.9°C, 17 June 1983, 108 spms; Sta. 84.03.15.2, Lat: 68.891 Long: -14.238, 1588 m, -0.9°C, 15 Mars 1984, 2 spms; Sta. 84.05.23.1, Lat: 62.585 Long: 01.793, 656 m, -0.8°C, 23 May 1984, 80 spms; Sta. 84.05.23.2, Lat: 62.590 Long: 01.795, 650 m, 23 May 1984, 4 spms; Sta. 84.05.23.3, Lat: 62.508 Long: 01.851, 576 m, -0.4°C, 23 May 1984, 1 spm; Sta. 84.05.23.5, Lat: 62.603 Long: 02.233, 576 m, -0.8°C, 23 May 1984, 6 spms; Sta. 84.11.20.2, Lat: 63.133 Long: 01.895, 1087 m, -0.9°C, 20 Nov. 1984, 28 spms; Sta. 84.11.21.1, Lat: 62.791 Long: 01.836, 811 m, -0.9°C, 21 Nov. 1984, 3 spms; Sta. 84.11.21.2, Lat: 62.553 Long: 01.820, 625 m, -0.8°C, 21 Nov. 1984, 53 spms; Sta. 85.01.08.1, Lat: 62.525 Long: 01.443, 701 m, -0.9°C, 8 Jan. 1985, 75 spms; Sta. 85.01.08.2, Lat: 62.706 Long: 01.186, 897 m, -0.9°C, 8 Jan. 1985, 34 spms; Sta. 85.01.08.3, Lat: 62.911 Long: 00.928, 1112 m, -0.9°C, 8 Jan. 1985, 14 spms; Sta. 85.01.08.4, Lat: 63.291 Long: 00.471, 1698 m, -0.9°C, 8 Jan. 1985, 1 spm; Sta. 85.01.12.2, Lat: 63.166 Long: 00.643, 1489 m, -0.9°C, 12 Jan. 1985, 8 spms; Sta. 85.01.12.3, Lat: 63.048 Long: 00.796, 1293 m, -0.9°C, 12 Jan. 1985, 12 spms; Sta. 86.06.12.2, Lat: 63.638 Long: -07.025, 1533 m, -0.9°C, 12 June 1986, 2 spms; Sta. 86.06.13.1, Lat: 63.218 Long: -07.031, 1261 m, -0.8°C, 13 June 1986, 2 spms; Sta. 86.06.13.4, Lat: 63.045 Long: -07.028, 1022 m, -0.8°C, 13 June 1986, 2 spms; Sta. 86.06.13.5, Lat: 62.948 Long: -07.002, 748 m, -0.6°C, 13 June 1986, 1 spm; Sta. 86.06.16.1, Lat: 62.855 Long: -05.698, 750 m, -0.4°C, 16 June 1986, 6 spms; Sta. 86.07.25.1, Lat: 69.023 Long: -08.410, 879 m, -0.6°C, 25 July 1986, 464 spms; Sta. 86.07.27.2, Lat: 70.810 Long: -09.728, 886 m, -0.6°C, 27 July 1986, 234 spms; Sta. 86.07.27.5, Lat: 70.678 Long: -07.631, 1243 m, -0.6°C, 27 July 1986, 9 spms; Sta. 86.07.31.1, Lat: 63.103 Long: -00.841, 1751 m, -0.9°C, 31 July 1986, 8 spms; Sta. 86.08.15.5, Lat: 62.610 Long: 01.573, 654 m, -0.9°C, 15 Aug. 1986, 44 spms; Sta. 86.08.15.7, Lat: 62.843 Long: 01.431, 951 m, -0.9°C, 15 Aug. 1986, 8 spms; Sta. 86.08.16.2, Lat: 63.118 Long: 00.851, 1342 m, -0.9°C, 16 Aug. 1986, 9 spms; Sta. 86.08.17.3, Lat: 63.368 Long: 00.551, 1750 m, -0.9°C, 17 Aug. 1986, 2 spms; Sta. 86.08.17.5, Lat: 62.996 Long: 01.140, 1143 m, -0.9°C, 17 Aug. 1986, 11 spms; Sta. 86.08.17.6, Lat: 62.691 Long: 01.756, 750 m, -0.9°C, 17 Aug. 1986, 132 spms; Sta. 87.06.13.1, Lat: 69.978 Long: 12.545, 1832 m, -0.9°C, 13 June 1987, 1 spm. R/V 'Jan Mayen' stations: Sta. 808-99, Lat: 70.9768 Long: -08.7735, 109 m, 14 Sept. 1999, 1 spm; Sta. 813-99, Lat: 71.1068 Long: -09.5877, 514 m, 15 Sept. 1999, 22 spms; Sta. 834-99, Lat: 70.7512 Long: -07.9623, 771 m, 16 Sept. 1999, 104 spms; Sta. 848-99, Lat: 70.6478 Long: -09.3722, 599 m, 17 Sept. 1999, 7 spms; Sta. 850-99, Lat: 70.6032 Long: -09.3453, 313 m, 17 Sept. 1999, 4 spms. R/V 'Meteor' station: Sta. M414/90, Lat: 74.9667 Long: 14.0283, 1748 m, -1.1°C, 17 July 1990, 2 spms. R/V 'G.O. Sars' CGB stations: Sta. Dive-07, Lat: 71.2998 Long: -5.7800, 616 m, June 2006, 1 spm; Sta. Dive-12, Lat: 71.2997 Long: -5.7820, 616 m, June 2006, 2 spms. MAREANO stations: Sta. R405-59, RP, Lat: 72.14017 Long: 15.34583, 899 m, April 2009, 10 spms (3 mounted for SEM); Sta. R754-132, RP, Lat: 67.80459 Long: 9.68544, 823 m, 22 Sept. 2011, 21 spms; Sta. R882-12, RP, Lat: 67.28434 Long: 8.13304, 1117 m, 8 May 2012, 5 spms. Environmental monitoring stations: Sta. OL-01, Lat: 63.48446 Long: 05.36994, 837 m, 17 June 2004, 7 spms; Sta. OL-02, Lat: 63.49451 Long: 05.41986, 822 m, 17 June 2004, 5 spms; Sta. OL-03, Lat: 63.50035 Long: 05.36968, 867 m, 17 June 2004, 8 spms; Sta. OL-04, Lat: 63.51289 Long: 05.37823, 858 m, 18 June 2004, 6 spms; Sta. OL-

05, Lat: 63.50675 Long: 05.40527, 828 m, 17 June 2004, 3 spms; Sta. OL-06, Lat: 63.52350 Long: 05.37058, 870 m, 18 June 2004, 5 spms; Sta. OL-07, Lat: 63.52469 Long: 05.40486, 843 m, 18 June 2004, 2 spms; Sta. OL-08, Lat: 63.53813 Long: 05.38181, 852 m, 18 June 2004, 8 spms; Sta. OL-09, Lat: 63.53583 Long: 05.40537, 854 m, 18 June 2004, 5 spms; Sta. OL-10, Lat: 63.53050 Long: 05.43927, 810 m, 18 June 2004, 3 spms; Sta. OL-11, Lat: 63.55031 Long: 05.42835, 851 m, 18 June 2004, 11 spms; Sta. OL-12, Lat: 63.55516 Long: 05.36859, 901 m, 19 June 2004, 6 spms (2 mounted for SEM); Sta. OL-13, Lat: 63.56073 Long: 05.39664, 883 m, 19 June 2004, 1 spm; Sta. V-02, Lat: 63.50148 Long: 02.33322, 1325 m, 1 June 1998, 1 spm; Sta. V-06, Lat: 63.50074 Long: 05.33366, 913 m, 1 June 1998, 5 spms; Sta. V-09, Lat: 65.00138 Long: 05.00019, 757 m, 1 June 1998, 6 spms; Sta. V-16, Lat: 67.00162 Long: 07.33367, 1174 m, 1 June 1998, 2 spms.

Redescription. Lectotype complete specimen with everted proboscis, anterior end swollen in chaetigers 2–8, 13 mm body length for 32 chaetigers (Fig. 1B). Paralectotypes three complete specimens with some damage, measuring 11 mm for 31 chaetigers, 14 mm for 34 chaetigers, and 16 mm for 34 chaetigers, respectively. Among the original material is also one anterior fragment with 6 chaetigers, one mid-body fragment, and two posterior parts.

Length of complete specimens 4–35 mm for 29–36 chaetigers. Body elongated, tapering posteriorly. Preserved specimens usually swollen in anterior chaetigers (Figs 1, 2A–B).

Prostomium T-shaped, squarish with a pair of prominent horns projecting anterolaterally (Fig. 2A, C). Nuchal slits on either side of prostomium, eversible nuchal organs observed in a few specimens. Peristomium achaetous, narrow dorsally, expanding laterally to a broad ring ventrally. Mouth ventral, peristomium and first chaetiger fused. Proboscis a large smooth sac, occasionally everted (Figs 1B, 2D).

Dorsal body surface with rectangular pads (Fig. 2A). Dorsal body surface with secondary annulations arranged as a double row of pads dorsal to notopodia, in addition an intermediate annulation between chaetigers; annulations similar throughout, smoothed out but visible in swollen area (Fig. 2A). Ventrally body surface with a longitudinal midventral furrow, midventrally with a prominent longitudinal row of rectangular pads, most prominent in anterior half of body (Fig. 2B). Pygidium rounded with a dorso-ventral indentation (Fig. 2E), and smooth folds on the rim. Pygidial cirri absent.

Parapodia on anterior part of body inconspicuous, with noto- and neuropodium well separated. In anterior chaetigers prechaetal lobe present in noto- and neuropodia, on chaetiger 1–2 prechaetal lobe barely visible (Fig. 2F), evident from chaetiger 3–4. Parapodia gradually becoming more developed from chaetiger 12 (Figs 1, 2A). Notopodium rounded in first few chaetigers from 12 (Fig. 2G), becoming more produced posteriorly (Figs 1D, 2H). Neuropodium rounded from chaetiger 12, becoming increasingly produced posteriorly (Figs 1D, 2H). Noto- and neuropodium more or less equal in size. Dorsal and ventral cirri present from chaetiger 12. Dorsal cirri rounded knoblike, shorter than notopodium from chaetiger 12 (Fig. 2G), becoming as long as notopodium posteriorly (Fig. 1D). Ventral cirri barely visible on chaetigers 12–13, appearing as a low brim from chaetiger 14, then becoming increasingly rounded to elliptical posteriorly, as long as or slightly longer than neuropodium from chaetigers 20–25 (Figs 1D, 2H). Interramal papilla present, knoblike (Fig. 1D).

Chaetae include hirsute slender capillaries in noto- and neuropodia in all chaetigers (Fig. 3). Chaetiger 1 with one row of small pointed spines with bifurcate tips (Fig. 3A–B) placed anterior to capillaries in both noto- (Fig. 3A) and neuropodia (Fig. 3D). Furcate chaetae present from chaetiger 2 in both notopodia and neuropodia, having unequal tines in anterior chaetigers (Fig. 3E–F), approaching more or less equal length in posteriormost chaetigers (Fig. 3G), with dentation on inner side of tines (Fig. 3F–H). Furcate chaetae occasionally found in chaetiger 1 (Fig. 3C) in both noto- and neuropodia, (not observed in all specimens). Chaetae numerous and long, organised in rows with one anterior row of furcate chaetae followed by 3–4 rows of capillaries. Chaetae most numerous in anterior chaetigers, length of chaetae subject to variation over specimens.

Reproduction. Several ovigerous females observed in January (R/V “*H. Mosby*” Sta. 85.01.08.1). Diameter of eggs up to 200 μ m.

Remarks. The original material used by Hansen (1879) to describe *P. parvum* from stations 18 and 31 from The Norwegian North-Atlantic Expedition 1876–78 were found in one vial (ZMBN 2275). The material consists of 4 complete specimens, of which 3 are damaged. In the original description Hansen stated that one specimen with damage to the mid-body was from Sta. 18, which is easy to identify among the specimens. Hence, the remaining specimens are from Sta. 31. An undamaged specimen agrees with the original description and illustration and is selected as the

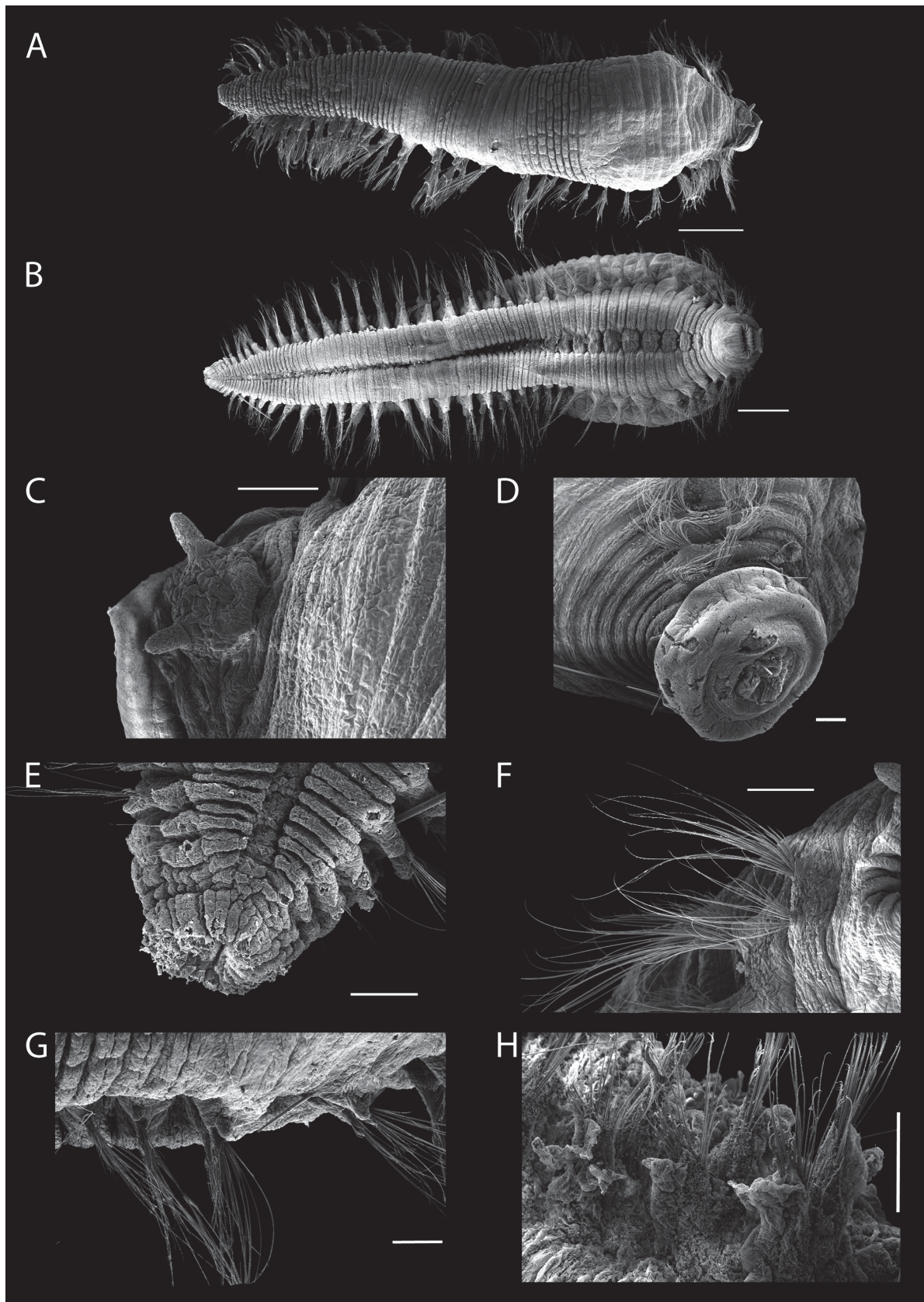


FIGURE 2. *Pseudoscalibregma parvum*. A. Habitus SEM photo, dorsal view. B. Habitus SEM photo, ventral view. C. Prostomium dorsal view. D. Anterior end with everted proboscis. E. Ventral view of pygidium. F. Chaetiger 1, right parapodium, anterior view. G. Chaetigers 13–16, dorsal view. H. Chaetigers 21–23, posterior view, showing neuropodial lobe and ventral cirri, left side. A–C, E–G specimen from close to type locality, Sta. OL-12, D, H specimens from west of the Bear Island, Sta. R405-59B, RP. Scale bars: A–B: 1 mm, C–H: 200 μ m.

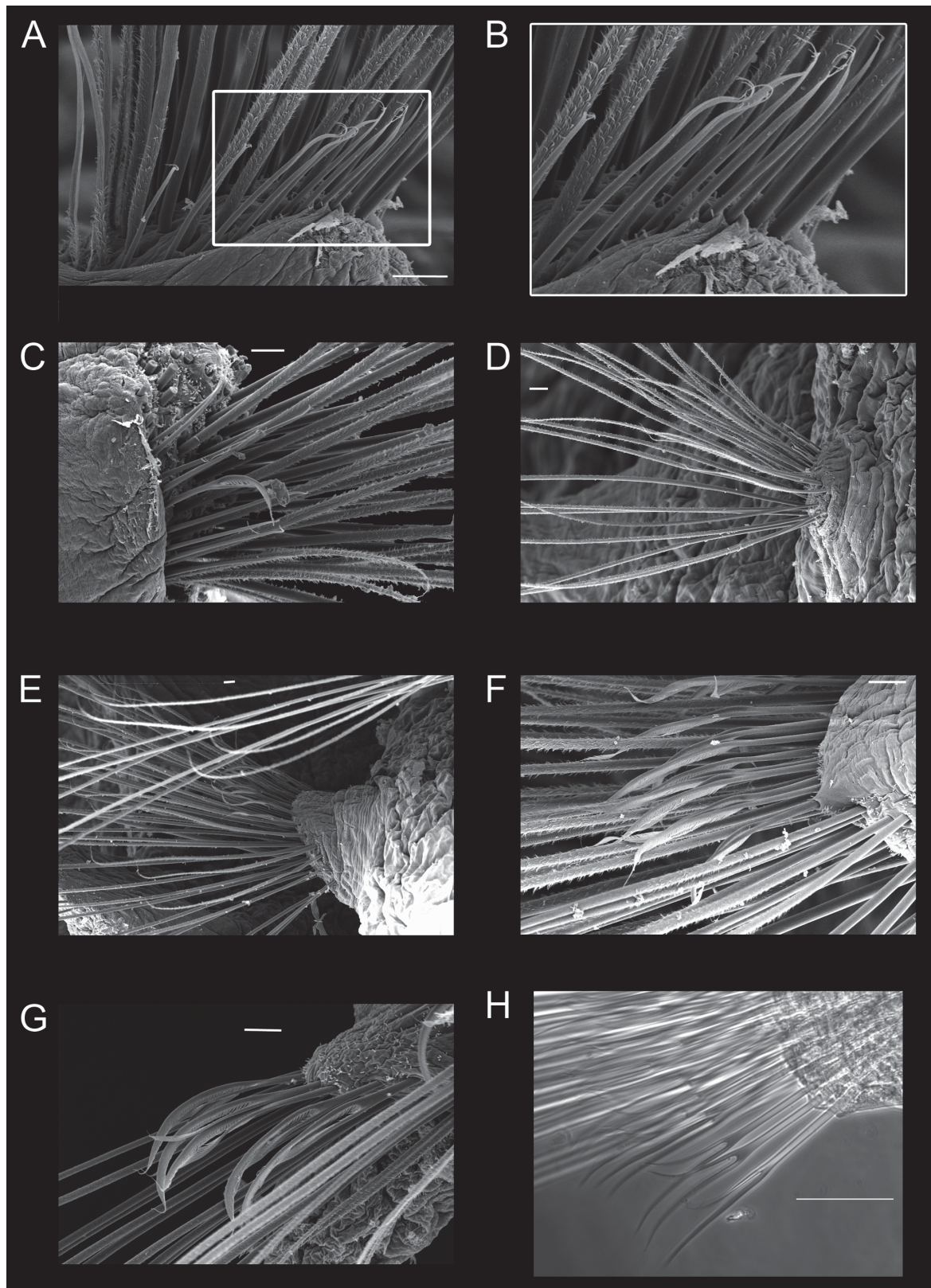


FIGURE 3. *Pseudoscalibregma parvum*. A. Chaetiger 1, notopodium, anterior view, with small bifurcate spines in front row of chaetae. B. Close up of A, showing bifurcate spines. C. Chaetiger 1, notopodium, anterior view, with furcate chaetae. D. Chaetiger 1 neuropodium anterior view. E. Chaetiger 3, neuropodium, anterior view. F. Chaetiger 3, neuropodium, furcate chaetae in front row. G. Posterior chaetiger (fourth from pygidium), ventral view. H. Light microscope photo, phase contrast, of furcate chaetae from dorsal part of notopodium, chaetiger 9. A–B, D–H specimen from close to type locality, Sta. OL-11; C specimen from west of the Bear Island, Sta. R405-59, RP. Scale bars: A, C–G: 10 µm, H: 50 µm.

lectotype; the remaining 3 specimens thereby becoming paralectotypes. The two stations where the original material was collected were relatively close to the shelf break in the Norwegian Sea at 753 m (Sta. 18) and 763 m (Sta. 31) depth. Both stations were reported to have a water temperature at the bottom of -1 °C (Hansen 1882). By selecting a lectotype from Sta. 31, the type locality is fixed to this position.

Small pointed spines were observed on chaetiger 1; in most cases with a bifurcated tip (Fig. 3B). The spines are similar to those described in *Scalibregma inflatum* (Mackie 1991) and *Pseudoscalibregma orientalis* (Imajima 2009). The observation of small spines on chaetiger 1 in two species of *Pseudoscalibregma* suggests that this represents a character that may be found in other species in this genus as well.

The number of chaetigers is generally stable. The majority of specimens have 33–34 chaetigers, largely irrespective of body length. The observed range is 29–36 chaetigers in specimens measuring from 4 mm to 35 mm in body length.

There are presently six valid species in *Pseudoscalibregma*, of which *P. parvum* is the only species in the Nordic Seas and the North Atlantic. *Pseudoscalibregma parvum* is most similar to *P. orientalis* Imajima, 2009 from Japan, but is distinguished by having a smooth proboscis, which is papillated in *P. orientalis*, by having short dorsal and ventral cirri, which are very long in *P. orientalis*, and by having parapodial lobes and cirri present from chaetiger 12, in contrast to chaetiger 14 in *P. orientalis*. *Pseudoscalibregma papilia* Schüller, 2008 possesses very large inflated cirri in posterior parapodia (Schüller 2008), as does *P. bransfieldium* (Hartman, 1967) (Blake 1981). In *P. usarpium* Blake, 1981 dorsal and ventral cirri commence on chaetiger 12, as in *P. parvum*, but *P. usarpium* differs from all other species of *Pseudoscalibregma* in the shape of the prostomium and by possessing papillae on the dorsum (Blake 1981).

Théel (1879) gave a rather detailed description of *Eumenia longisetosa* based on specimens from six stations at Novaja Zemlja and in the Kara Sea, Russia. Furreg (1925) extended the species description (as *Pseudoscalibregma longisetosum*) based on the original material and specimens from several other Arctic localities. He also discussed *P. parvum* and considered Hansen's description to represent young specimens of *P. longisetosum*. Later, Støp-Bowitz (1945) confirmed the synonymy of the species, but indicated that Hansen's name was published first and took priority. There is no indication that Støp-Bowitz actually studied Théel's specimens. In the present study the available material from Théel's description was examined. None of the vials is labelled as type material or in any way indicated as such. There are some discrepancies in positions and depths as well as station numbers compared to the station list in the original description, but the specimens obviously represent those used by Théel for his description. No morphological differences between Théel's specimens and Hansen's specimens were found. Hence, the two names must be regarded as synonymous.

The descriptions of *Scalibregma parvum* and *Eumenia longisetosa* were both published in 1879. Støp-Bowitz (1945) argued that Hansen's name was the oldest by referring to a citation of Hansen's work in Théel (1879, p. 9: synonymy list for *Polynoe imbricata*) with the year 1877 or 1878 and indicated as a separate offprint. The case is not fully clear, but Hansen's name has been used consistently in the literature following Støp-Bowitz (1945). To provide stability we suggest that this should be continued.

Distribution. *Pseudoscalibregma parvum* has been recorded from East Greenland, Jan Mayen, Spitsbergen, Norwegian Sea and Kara Sea, in depths from 20 to 1715 m (this study; Furreg 1925; Støp-Bowitz 1948; Jirkov 2001; Bakken et al. 2010). The shallowest records are all Arctic, from East Greenland and the Kara Sea. On the shelf around the island of Jan Mayen some shallow records, from 109 m, are from an area with mixed North Atlantic and Arctic water masses with temperatures down to below 0°C (Bakken et al. 2010). In the Norwegian Sea there are a few records in shelf areas, but most records are from 600 m and deeper, where water temperatures are below 0°C (Fig. 7A).

***Scalibregma* Rathke, 1843**

Scalibregma Rathke, 1843: 182–184.—Blake 2000: 132.

Type species: *Scalibregma inflatum* Rathke, 1843

Diagnosis. Body elongate, arenicoliform. Prostomium T-shaped with distinct lateral horns. Parapodia of posterior segments with dorsal and ventral cirri, interramal papillae or cilia present; postchaetal lamellae absent. Branchiae present. Chaetae including capillaries, lyrata chaetae, and sometimes few inconspicuous spines, blunt or bifurcated

among capillaries of chaetigers 1–2, representing precursors of lyrate chaetae; large conspicuous spines absent. Pygidium with long anal cirri (Blake 2000: 132).

***Scalibregma abyssorum* Hansen, 1879, nomen dubium**

Scalibregma (?) *abyssorum* Hansen, 1879: 6–7, pl. V, figs 1–6.—1882: 34–35.

Scalibregma abyssorum.—Furreg 1925: 170.

Scalibregma inflatum.—Støp-Bowitz 1945: 70–71.

Material examined. The Norwegian North-Atlantic Expedition 1876–1878, Norwegian continental shelf break, Sta. 18, 62°44'N 1°48'E, 753 m, holotype of *Scalibregma abyssorum* (ZMBN 2274).

Remarks. The description of *Scalibregma abyssorum* was based on one incomplete specimen (Hansen 1879; 1882). The species was stated to have three segments with gills, a squarish prostomium without lateral processes, anterior segments with no dorsal annulation, and furcate chaetae in neuropodia only. One incomplete specimen labelled as original material is kept in the collections of the University Museum of Bergen. Støp-Bowitz (1945) examined the specimen and noted that it had four pairs of branchiae and a prostomium with frontal horns. The branchiae were situated on chaetigers 2–5, as in *S. inflatum*. He concluded that it referred to a small specimen of *S. inflatum*. The examination of the specimen in the present study supports the observations by Støp-Bowitz (1945). The specimen is damaged, broken after chaetiger 13, and has lost parapodia on the right side. Bushy gills are present on chaetigers 2–5. The specimen, however, differs in several respects from the description and figures given by Hansen (1879, 1882), for instance in the dorsal annulation of segments, the development of prostomial frontal horns, and the number of gills. It may therefore be suspected that the deposited specimen is not the one Hansen (1879; 1882) used for his species description. The species is here considered indeterminable.

***Scalibregma inflatum* Rathke, 1843**

Scalibregma inflatum Rathke, 1843: 184–186, pl. IX, figs 15–21.—Furreg 1925: 157–163, figs C–H.—Støp-Bowitz 1945: 67–72, fig. 2; 1948: 25–26, fig. 8.—Mackie 1991: 268–271, figs 1–10.

Oligobranchus roseus M. Sars, 1846: 91–94, pl. 10, figs 20–27.

Type localities. *Scalibregma inflatum*: near Molde, western Norway. *Oligobranchus roseus*: Florø, western Norway.

Material examined. The Norwegian North-Atlantic Expedition 1876–1878, Norwegian continental shelf break, Sta. 18, 62°44'N 1°48'E, 753 m, 1 spm (ZMBN 2276), identified by Hansen (1882). R/V 'Håkon Mosby' stations: Sta. 82.01.21.2, Lat: 62.491 Long: 01.721, 604 m, 1.1°C, 21 Jan. 1982, 1 spm; Sta. 83.06.02.1, Lat: 62.198 Long: -00.003, 708 m, -0.3°C, 02 June 1983, 1 spm; Sta. 83.06.17.3, Lat: 62.593 Long: 01.233, 781 m, -0.9°C, 17 June 1983, 2 spms; Sta. 84.11.21.2, Lat: 62.553 Long: 01.820, 625 m, -0.8°C, 21 Nov. 1984, 3 spms; Sta. 85.01.08.1, Lat: 62.525, Long: 01.443, 701 m, -0.9°C, 8 Jan. 1985, 6 spms; Sta. 86.07.27.2, Lat: 70.810 Long: -09.728, 886 m, -0.6°C, 27 July 1986, 1 spm; Sta. 86.08.15.5, Lat: 62.610 Long: 01.573, 654 m, -0.9°C, 15 Aug. 1986, 1 spm; Sta. 86.08.17.6, Lat: 62.691 Long: 01.756, 750 m, -0.9°C, 17 Aug 1986, 4 spms. R/V 'Jan Mayen' stations: Sta. 808-99, Lat: 70.9768 Long: -08.7735, 109 m, 14 Sept. 1999, 17 spms; Sta. 813-99, Lat: 71.1068 Long: -09.5877, 514 m, 15 Sept. 1999, 1 spm. Environmental monitoring stations: Sta. OL-02, Lat: 63.49451 Long: 05.41986, 822 m, 17 June 2004, 2 spms; Sta. OL-03, Lat: 63.50035 Long: 05.36968, 867 m, 17 June 2004, 7 spms; Sta. OL-04, Lat: 63.51289 Long: 05.37823, 858 m, 18 June 2004, 3 spms; Sta. OL-05, Lat: 63.50675 Long: 05.40527, 828 m, 17 June 2004, 2 spms; Sta. OL-06, Lat: 63.52349 Long: 5.37058, 870 m, 18 June 2004, 4 spms; Sta. OL-07, Lat: 63.52469 Long: 05.40486, 843 m, 18 June 2004, 2 spms; Sta. OL-08, Lat: 63.53813 Long: 05.38181E, 852 m, 18 June 2004, 2 spms; Sta. OL-09, Lat: 63.53583 Long: 05.40537, 854 m, 18 June 2004, 2 spms; Sta. OL-10, Lat: 63.53050 Long: 05.43927, 810 m, 18 June 2004, 3 spms; Sta. OL-11, Lat: 63.55031 Long: 05.42835, 851 m, 18 June 2004, 6 spms; Sta. OL-12, Lat: 63.55516 Long: 05.36859, 901 m, 19 June 2004, 2 spms; Sta. OL-13, Lat: 63.56073 Long: 05.39664, 883 m, 19 June 2004, 2 spms; Sta. V-06, Lat: 63.50074 Long: 05.33366, 913 m, 01 June 1998, 6 spms; Sta. V-09, Lat: 65.00138 Long: 05.00019, 757 m, 01 June 1998, 2 spms.

Remarks. Type material of *Scalibregma inflatum* is not known to exist. Mackie (1991) gave a redescription of

S. inflatum based on specimens from the Sunndalsfjord in western Norway, close to the original type locality. He also confirmed the synonymy of *Oligobranchus roseus* with *S. inflatum* after examining a specimen of *O. roseus* kept at the Zoological Museum, University of Oslo, and presumed to be the material for the original description. M. Sars (1846) described *O. roseus*, being unaware of Rathke's description (note p. 94; 1846), but appears later to have accepted the synonymy (M. Sars in G. O. Sars 1872).

The specimens examined in the present study were all collected on the upper slope of the Norwegian continental margin, at depths greater than 600 m, and from Jan Mayen. The specimens agree with the description given by Mackie (1991). The presence of short, acute or bifurcate spines on chaetiger 1–2, as described by Mackie (1991), was confirmed.

Distribution. *Scalibregma inflatum* is known to have a wide distribution in northern coastal waters. Støp-Bowitz (1945, 1948) reported *S. inflatum* from a number of localities in Norwegian and Arctic areas in depths from 10 to 200 m. In deeper waters there are scattered records from west Greenland, Spitsbergen and Jan Mayen in 450–1275 m (Støp-Bowitz 1948). This study confirms the presence of the species in shelf break areas down to about 900 m depths in the Norwegian Sea (Fig. 7B). The species may seem to have a depth limit at about 1000 m in the Nordic Seas.

Scalibregma inflatum is reported from world-wide areas (Blake 1981). Most probably several species are confounded. Mackie (1991) commented that several descriptions in faunal works from the northeast Atlantic may incorporate *S. celticum* Mackie, 1991 as well.

***Scalibregma hansenii* n. sp.**

Figures 4–6

Type locality. Norwegian continental shelf break, 'Egga', west of Nordland County, 68°50.42'N 13°05.22'E, 765 m.

Type material. Holotype (ZMBN 94016), MAREANO Sta. R351-355, RP, 29 Oct. 2008, complete specimen, female with eggs in body cavity, in ethanol; 5 paratypes (ZMBN 94017), same sample as holotype, in ethanol; 1 paratype (ZMBN 94018), same sample as holotype, mounted for SEM; 1 paratype (ZMBN 94019), 1 paratype (ZMBN 94021) MAREANO Sta. R351-356, RP, from type locality, 29 Oct. 2008, in ethanol; 1 paratype (ZMBN 94020), same sample as previous, mounted for SEM.

Other material. R/V 'Håkon Mosby' stations: Sta. 81.03.21.1, Lat: 63.166 Long: 04.816, 830 m, -0.9°C, 21 Mar. 1981, 2 spms; Sta. 81.06.06.3, Lat: 65.686 Long: 05.633, 602 m, 0.3°C, 6 June 1981, 1 spm; Sta. 81.08.16.7, Lat: 62.553 Long: 00.981, 800 m, -0.9°C, 3 spms; Sta. 82.01.20.4, Lat: 62.495 Long: 02.136, 497 m, 2.2°C, 20 Jan. 1982, 1 spm; Sta. 82.01.21.2, Lat: 62.491 Long: 01.721, 604 m, 1.1°C, 21 Jan. 1982, 10 spms; Sta. 82.01.21.4, Lat: 62.560 Long: 00.981, 804 m, -0.9°C, 21 Jan. 1982, 1 spm; Sta. 82.11.27.1, Lat: 62.985 Long: 03.218, 804 m, -1.0°C, 27 Nov. 1982, 11 spms; Sta. 83.06.02.1, Lat: 62.198 Long: -00.003, 708 m, -0.3°C, 2 June 1983, 5 spms; Sta. 83.06.02.1, Lat: 62.198 Long: -00.003, 708 m, -0.3°C, 2 June 1983, 5 spms; Sta. 83.06.03.2, Lat: 60.201 Long: -06.625, 1220 m, -0.8°C, 3 June 1983, 4 spms; Sta. 83.06.17.3, Lat: 62.593 Long: 01.233, 781 m, -0.9°C, 17 June 1983, 17 spms; Sta. 84.05.23.1, Lat: 62.585 Long: 01.793, 656 m, -0.8°C, 23 May 1984, 3 spms; Sta. 84.05.23.2, Lat: 62.590 Long: 01.795, 650 m, 23 May 1984, 2 spms; Sta. 84.05.23.3, Lat: 62.508 Long: 01.851, 576 m, -0.4°C, 23 May 1984, 4 spms; Sta. 84.05.23.5, Lat: 62.603 Long: 02.233, 576 m, -0.8°C, 23 May 1984, 4 spms; Sta. 84.11.21.2, Lat: 62.553 Long: 01.820, 625 m, -0.8°C, 21 Nov. 1984, 8 spms; Sta. 85.01.08.1, Lat: 62.525 Long: 01.443, 701 m, -0.9°C, 8 Jan. 1985, 5 spms (1 mounted for SEM); Sta. 85.01.08.2, Lat: 62.706 Long: 01.186, 897 m, -0.9°C, 8 Jan. 1985, 4 spms; Sta. 86.07.25.1, Lat: 69.023 Long: -08.410, 879 m, -0.6°C, 25 July 1986, 7 spms; Sta. 86.07.27.2, Lat: 70.810 Long: -09.728, 886 m, -0.6°C, 27 July 1986, 5 spms (1 mounted for SEM); Sta. 86.07.27.5, Lat: 70.678 Long: 07.631, 1243 m, -0.6°C, 27 July 1986, 1 spm; Sta. 86.08.15.5, Lat: 62.610 Long: 01.573, 654 m, -0.9°C, 15 Aug. 1986, 1 spm; Sta. 86.08.15.7, Lat: 62.843 Long: 01.431, 951 m, -0.9°C, 15 Aug. 1986, 1 spm; Sta. 86.08.17.5, Lat: 62.996 Long: 01.140, 1143 m, -0.9°C, 17 Aug. 1986, 2 spms; Sta. 86.08.17.6, Lat: 62.691 Long: 01.756, 750 m, -0.9°C, 17 Aug. 1986, 16 spms. MAREANO stations: Sta. R351-355, RP, Lat: 68.84033 Long: 13.08700, 765 m, 29 Oct. 2008, 9 spms; Sta. R351-356, 68.84033N 13.08700E, 765 m, 29 Oct. 2008, 8 spms; Sta. R416-386, Lat: 71.93600 Long: 15.53133, 777 m, 22 April 2009, 10 spms; Sta. R464-143, Lat: 71.33700 Long: 16.51324, 853 m, -0.48°C, 25 Sept. 2009, 2 spms. Environmental monitoring stations: Sta. OL-01, Lat: 63.48446 Long: 05.36994, 837 m, 17 June 2004, 2 spms; Sta. OL-04, Lat: 63.51289 Long: 05.37823, 858 m,

18 June 2004, 1 spm; Sta. OL-06, Lat: 63.52350 Long: 05.37058, 870 m, 18 June 2004, 2 spms; Sta. OL-08, Lat: 63.53813 Long: 05.38181, 852 m, 18 June 2004, 1 spm; Sta. OL-13, Lat: 63.56073 Long: 05.39664, 883 m, 19 June 2004, 3 spm; Sta. V-07, Lat: 63.50149 Long: 05.65205, 591 m, 1 June 1991, 6 spms; Sta. V-09, Lat: 65.00138 Long: 05.00019, 757 m, 1 June 1998, 3 spms.

Description. Length of entire specimens 7–10 mm for 35–41 segments, width up to 1.9 mm. Body arenicoliform, anterior part swollen, posterior region tapered (Fig. 4). Holotype 9.5 mm long for 38 chaetigers, maximum width 1.8 mm, body swollen at chaetigers 5–13.

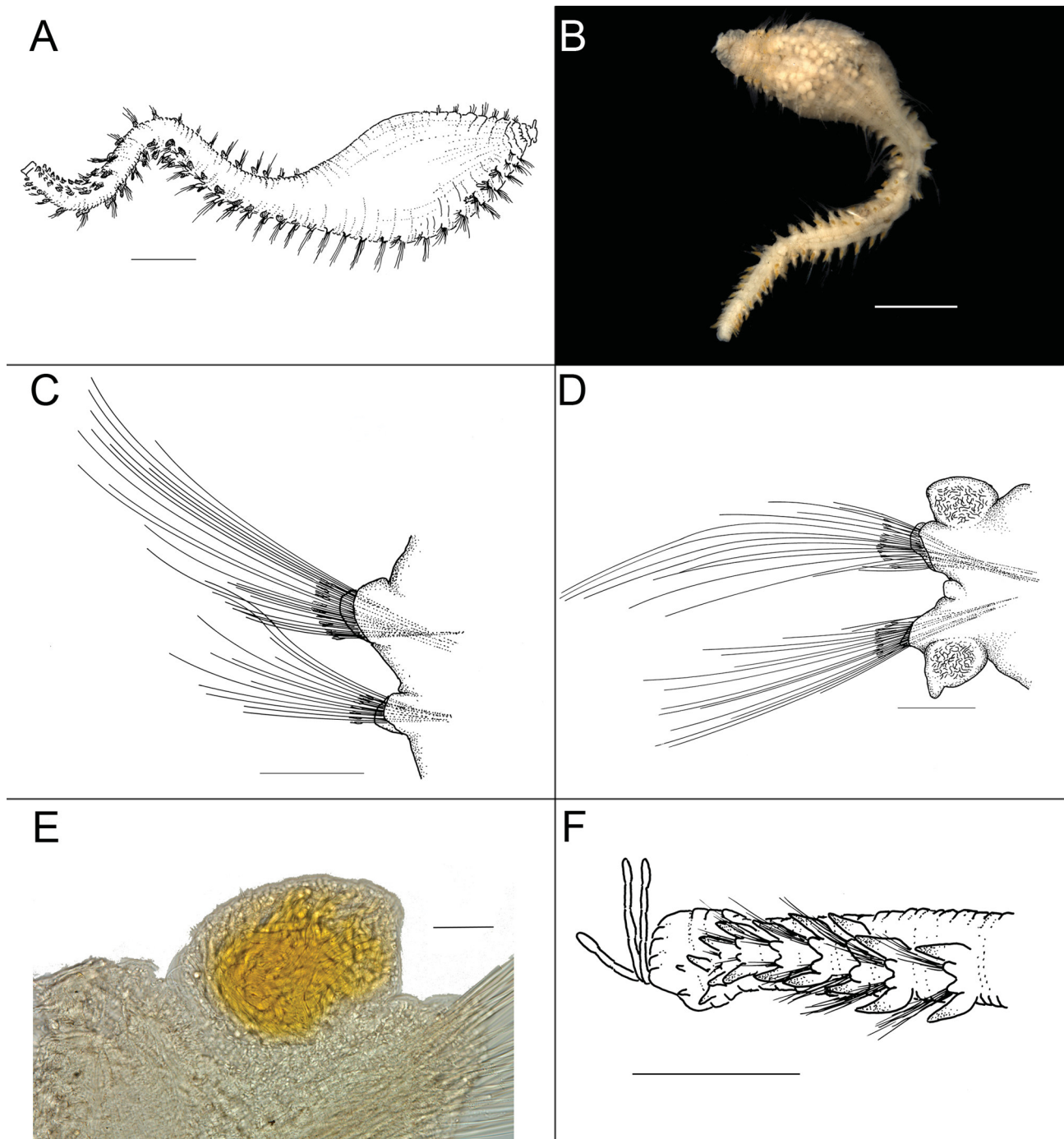


FIGURE 4. *Scalibregma hanseni* n. sp. A. Paratype, ZMBN 94019. B. Holotype, ventral view, ZMBN 94016. C. Left parapodium of chaetiger 10, posterior view. D. Left parapodium of chaetiger 21, posterior view. E. Close-up microphoto of dorsal cirrus with internal glandular structure, parapodium 21. F. Posterior end and pygidium with anal cirri. A from paratype, type locality, ZMBN 94019, and C–E from ZMBN 94021 Sta. R351-356. F specimen from Norwegian continental slope Sta. 84.05.23.1. Scale bars: A–B: 2 mm, C–D: 200 µm, E: 50 µm, F: 0.5 mm.

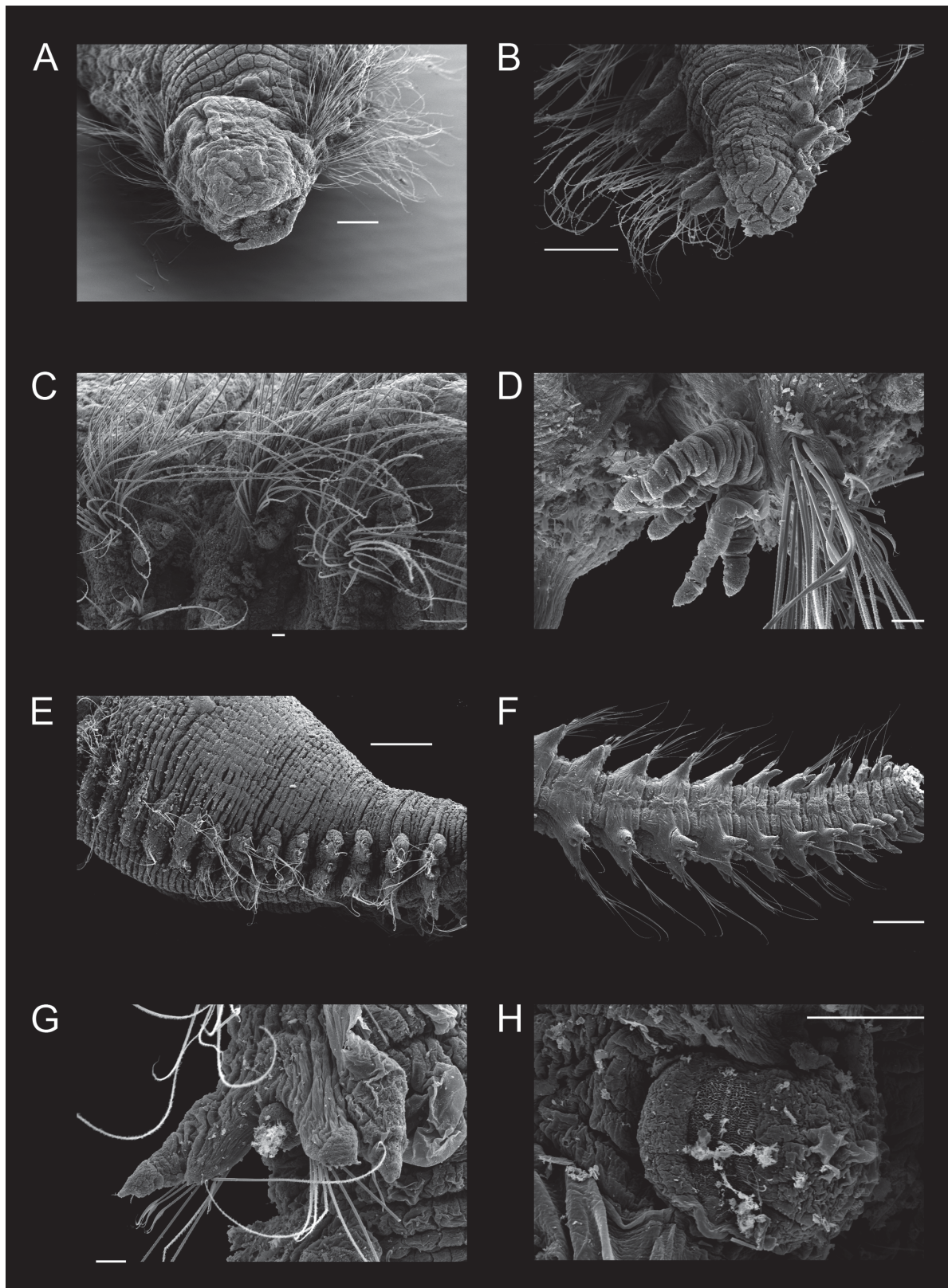


FIGURE 5. *Scalibregma hansenii* n. sp. Body structures. A. Prostomium and anterior chaetigers, dorsal view. B. Pygidium. C. Notopodia of chaetigers 3–5, with branchiae. D. Notopodium of chaetiger 4, with branchia, dorsal view. E. Middle body, chaetigers 6–18. F. Posterior body, ventral view. G. Posterior parapodium with interramal sense organ. H. Close-up of sense organ. A, B, C from paratype, ZMBN 94020, D specimen from Jan Mayen Sta. 86.07.27.2. E, G–H specimen from Norwegian continental slope, Sta. 85.01.08.1. F specimen from Norwegian continental slope, Sta. 83.06.17.3. Scale bars: A–B, E–F: 200 μ m; C–D, G–H: 20 μ m.

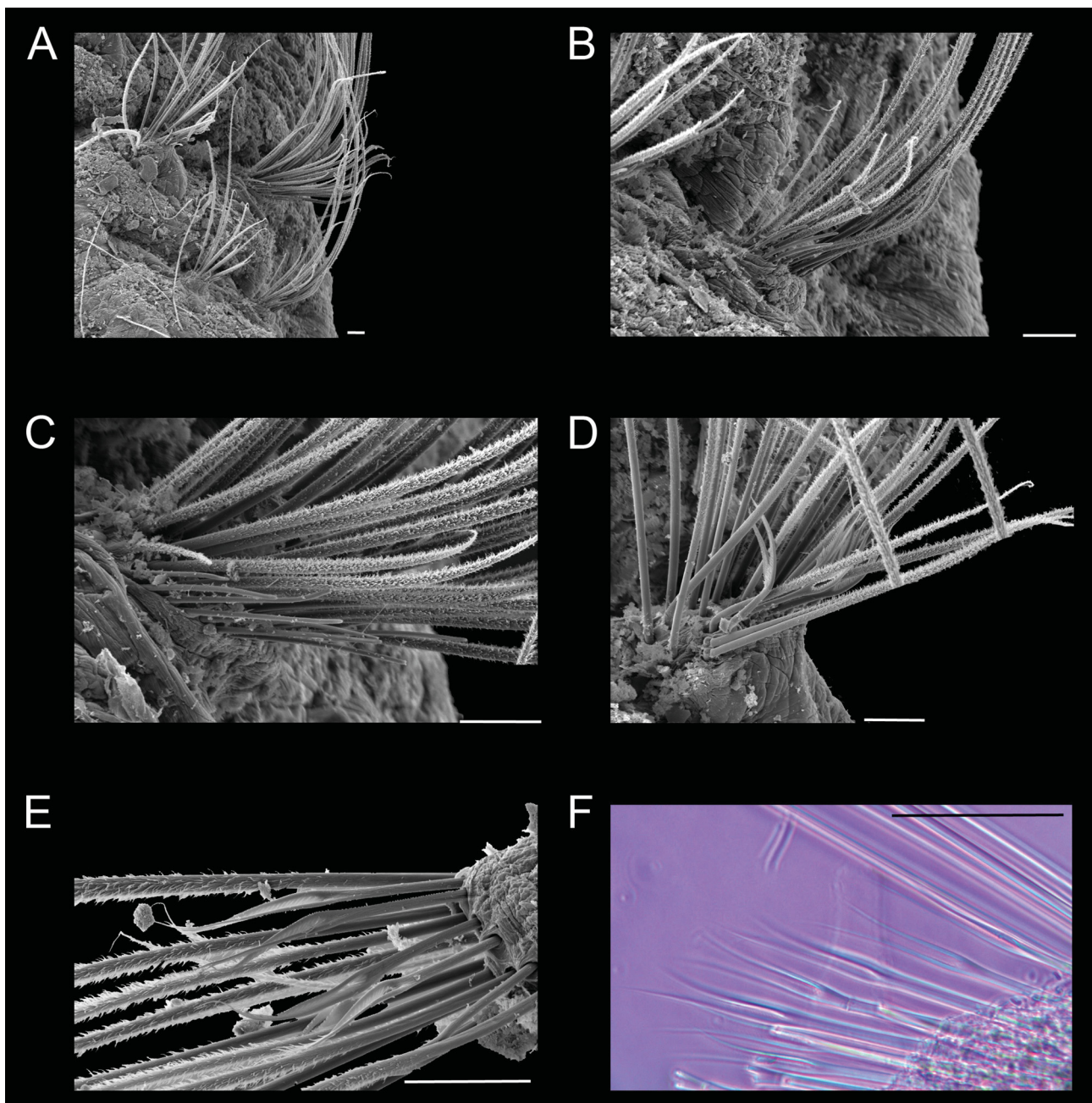


FIGURE 6. *Scalibregma henseni* n. sp. A. Parapodia of chaetigers 1 and 2, with capillary chaetae and blunt spines, anteroventral view. B. Close-up of notopodium of chaetiger 1. C. Close-up of notopodium of chaetiger 2. D. Notopodium of chaetiger 3, with capillary and furcate chaetae. E. Notopodium of chaetiger 4, with capillary and furcate chaetae. F. Microphoto, phase contrast, of furcate chaetae, neuropodium 20. A-D from paratype, ZMBN 94018, E specimen from Norwegian continental slope, Sta. 85.01.08.1, F from paratype, type locality, ZMBN 94021. Scale bars: A–E: 20 µm, F: 50 µm.

Prostomium T-shaped, with two long digitiform processes directed laterally or anterolaterally (Fig. 5A). Eyes lacking. Peristomium achaetous, dorsally well-developed with two rings and partly covering posterior part of prostomium, ventrally narrow. Mouth ventral, rounded oval, with broad anterior and posterior lips. Proboscis occasionally everted, simple or folded with undulating rim.

Peristomium and first chaetiger of about same width as posterior body. Following chaetigers gradually increasing in width, body swollen from chaetigers 5–7 to chaetigers 13–16 (Fig. 4A). Anterior segments with four annuli, segments posterior to swollen part with 5–6 annuli. Body surface tessellate. Ventral side with medial longitudinal furrow with rounded borders. Furrow with row of squarish epidermal pads (‘ventral shields’), one pad per segment, pads mostly indistinct in swollen region and posterior part of body (Fig. 4B). Pygidium rounded, with

ventral furrow and about ten short dorsal and lateral lobes (Fig. 5B). Anal cirri filiform, somewhat thicker distally than proximally, easily detached (Fig. 4F). Number of cirri not ascertained, up to five observed.

Three pairs of branchiae, situated on chaetigers 3–5. Branchiae mostly simple, consisting of 1–4 simple or partly subdivided filaments, arising posterior to notopodia (Fig. 5C, D). Branchiae usually increasing in size from anterior to posterior. Parapodia in anterior third of body small, inconspicuous, with low, evenly rounded prechaetal lobes in both rami (Fig. 4C). Parapodia gradually developing from chaetigers 10–12, becoming well-developed from about chaetigers 14–16 (Fig. 5E, 4D). Dorsal cirri appearing from chaetigers 13–14, short triangular on most of body, becoming lanceolate in far posterior chaetigers. Ventral cirri appearing from chaetigers 14–16, triangular in most anterior chaetigers, rapidly becoming more pointed to lanceolate in following chaetigers (Fig. 5F). Dorsal and ventral cirri with internal glandular structure, yellow coloured in preserved specimens (Fig. 4E). Papillate interramal sense organ from about chaetiger 15 to posterior end (Fig. 5G–H).

All chaetigers with slender capillaries in both rami. First and second chaetiger in addition with gently curved, thin, blunt-tipped spines anterior to capillaries (Fig. 6A–C), first chaetiger with 4–6 spines in both rami, second chaetiger with 6–8 somewhat longer spines. Notopodial spines located in a slightly curved vertical row in lower part of chaetal fascicle, neuropodial spines in a vertical row anterior to capillaries. All following chaetigers with furcate chaetae in both rami, located in a vertical row anterior to capillaries. Chaetiger 3 with 7–8 furcate chaetae, further back 8–12 (Fig. 6D–E). Tines of furcate chaetae of unequal lengths (ratio 1.15:1.35), longest tine with thin whip-shaped distal part, inner margin of tines with strong comb of teeth (Fig. 6E–F). Capillaries hirsute, blunt spines and furcate chaetae with even surface structure (Fig. 6).

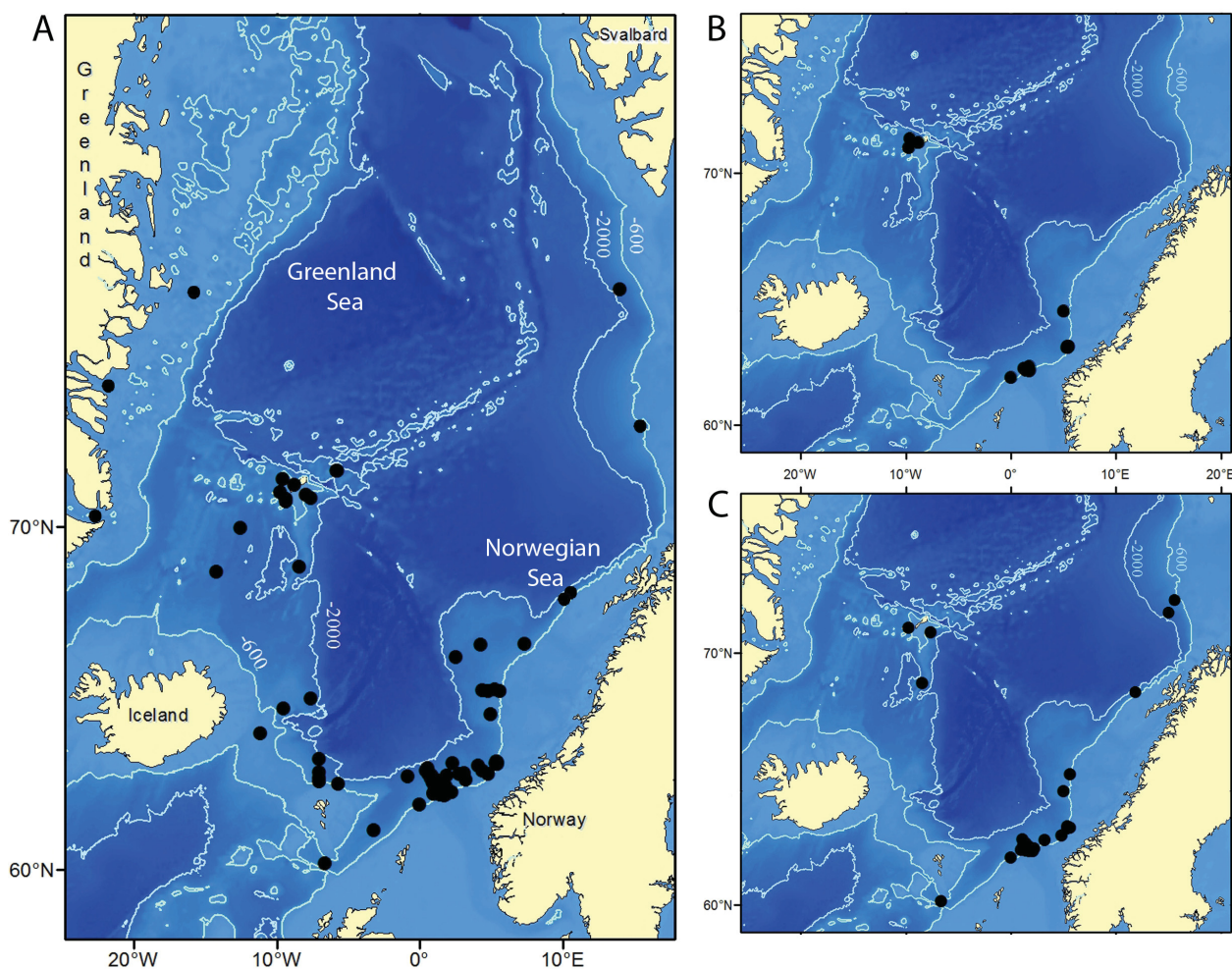


FIGURE 7. Present study records of *Pseudoscalibregma parvum* (A), *Scalibregma inflatum* (B), and *Scalibregma hanseni* n. sp. (C) from deep areas of the Nordic Seas.

Colour. Alcohol-preserved specimens light grey-brownish. Dorsal and ventral cirri usually bright yellow to brownish from colouring of internal glandular structure. Some specimens with transverse bands of light brownish epidermal pads on swollen part of body. Holotype with yellow transversal pigment bands dorsally on chaetigers 3–5, dorsal and ventral cirri in posterior body yellow.

Reproduction. Ovigerous females observed in samples from continental shelf break off Nordland County at 68° N, 765 m, October 2008. Diameter of eggs up to 180 µm. Holotype with eggs 120–140 µm in diameter.

Distribution. The species has been found on the continental slope in the eastern Norwegian Sea, from deep areas around Jan Mayen, and from a single record on the Wyville-Thomson Ridge at 1220 m depth (Fig. 7C). The depth range is 497–1243 m. Most samples are from the upper slope (600–800 m), coinciding with a transition zone from temperate North Atlantic water to cold Norwegian Sea water, with temperatures fluctuating around 0°C.

Etymology. This species is named after Gerhard Armauer Hansen for his contribution on polychaetes in the Norwegian Sea. In his treatment of the polychaetes from the Norwegian North-Atlantic Expedition 1876–1878, he described *Pseudoscalibregma parvum* and provided a description of *Scalibregma abyssorum*, which may have included material of the present species (Hansen 1879, 1882).

Remarks. Presently six species are considered valid in the genus *Scalibregma*. Four species are found in NE Atlantic and Arctic waters, viz. *S. inflatum*, *S. robustum* Zachs, 1925, *S. wireni* Furreg, 1925, and *S. celticum* Mackie, 1991, and two species are found in US coastal waters: *S. stenocerum* (Bertelsen & Weston, 1980), and *S. californicum* Blake, 2000. *Scalibregma hanseni* n. sp. shares with *S. stenocerum* the possession of three pairs of branchiae (on chaetigers 3–5), whereas all other species have four pairs of branchiae. *Scalibregma hanseni* n. sp. differs from *S. stenocerum* by having short rather than long, slender prostomial horns, by lacking eyes, and by having rather simple branchiae with few branches in contrast to bushy, multibranched branchiae.

Scalibregma hanseni n. sp., *S. stenocerum* and *S. celticum* all have smooth blunt spines on chaetigers 1 and 2. Mackie (1991) discussed the taxonomic relevance of spines on the most anterior chaetigers and their possible homology with furcate chaetae in more posterior chaetigers.

Discussion

A way to systematise morphological characters to define genera and delineate species into current genera was outlined by Kudenov and Blake (1978) and Blake (1981). This system has later proved to be inappropriate (Blake 2000), as more species have been described presenting more complicated characters. In this study, small spines on the most anterior chaetigers were documented for both *Pseudoscalibregma parvum* and *Scalibregma hanseni* n. sp. The spines were clearly seen using SEM, indicating that very careful microscopy is needed to detect important characters. The presence or absence of spines was considered important for generic distinction by Blake (1981; 2000). The recent observations of small spines in several species (Mackie 1991; Imajima 2009; this study) suggest a need to reassess the importance of spines, or at least the shape and strength of the spines, for separation of genera. Another character that may be taxonomically important is the first occurrence of notopodial lobes and cirri on a specific chaetiger, which is the case for *P. usarpium* (Blake 1981), *P. orientalis* (Imajima 2009), and *P. parvum* (this study). The diagnosis of *Pseudoscalibregma* was here emended to accommodate the presence of spines. As all known species have not been studied in detail, however, new observations would be needed to see if the emendations are adequate for all described species in both genera.

Observations of new characters and precise knowledge of character diversity in general are taxonomically important. In this study additional material of *Scalibregma* from shallow and shelf waters in the Norwegian Sea (< 500 m depth) was examined, in order to assess the full depth range of *S. inflatum*. However, in the material there were scattered specimens with three or four pairs of branchiae which otherwise were morphologically different from *S. hanseni* n. sp. and *S. inflatum*. Based on these observations, *Scalibregma* species from costal and shelf areas will be further studied by a combination of careful morphological examination and molecular markers.

A large number of samples have been available for this study, covering stations from the shelf to the deepest parts (about 4000 m) of the Norwegian Sea. *Pseudoscalibregma parvum* is the most abundant species and was found in a large number of samples. The depth range from 600 to 1715 m in the Norwegian Sea restricts *P. parvum* to areas with cold water masses with temperatures below 0°C and a mixing zone (600–800 m) with temperatures fluctuating from 6° to 7°C in Atlantic water masses to below 0°C in Arctic intermediate water. The more shallow

records are from cold Arctic waters. *Scalibregma hanseni* n. sp. is found in a more narrow depth range of 497–1243 m, also from mixed and cold waters. Both *P. parvum* and *S. hanseni* n. sp. are restricted to the continental slope and do not penetrate further into the deeper parts of the slope. The depth distribution of *S. inflatum* seems to be restricted to the shelf and upper continental slope, and mostly to water masses with temperatures higher than 0°C.

The depth range of the species appears to be related to the distribution of water masses and the temperature regime in the deep Nordic Seas. Similar results have been reported for *Ophelina* species from the Nordic Seas (Kongsrud *et al.* 2011). The scalibregmatids do not, unlike one opheliinid species (*Ophelina opisthobranchiata*), penetrate into the deep basins of the Nordic Seas. It appears that there is a species shift on the slope, with a zone where species with shallow and deep depth distribution restrictions are found, representing a zone with high diversity.

Acknowledgements

The present work has been prepared as part of a project on taxonomic studies of polychaetes in deep areas of the Norwegian Sea financed by the Norwegian Deepwater Programme (NDP), administered by the Norwegian Academy of Science and Letters (DNVA). Torleiv Brattegard, the MAREANO programme and the Centre for Geobiology, University of Bergen is thanked for providing access to material. We are grateful to Katrine Kongshavn and Tom Alvestad for sorting of material, to Katrine Kongshavn and the staff at the Laboratory for Electron Microscopy, UoB for taking the SEM images and to Katrine for preparation of figures, to Nataliya Budaeva for translation of text from Jirkov (2001), and to Elin Sigvaldadóttir for loan of specimens from the SMNH. We are grateful to James A. Blake and Danny Eibye-Jacobsen for valuable comments on the manuscript.

References

- Ashworth, J.H. (1901) The anatomy of *Scalibregma inflatum* Rathke. *Quarterly Journal of Microscopical Science, London*, 45, 237–309.
- Bakken, T., Kongsrud, J.A., Oug, E., Cochrane, S.K.J., Moen, T.L. & Solbakken, B.E.B. (2010) Polychaetes from Jan Mayen (Annelida, Polychaeta). *Polar Research*, 29, 1–21.
<http://dx.doi.org/10.1111/j.1751-8369.2009.00132.x>
- Bertelsen, R.D. & Weston, D.P. (1980) A new species of *Sclerobregma* (Polychaeta: Scalibregmatidae) from off the southeastern United States. *Proceedings of the Biological Society of Washington*, 93, 708–713.
- Blake, J.A. (1981) The Scalibregmatidae (Annelida: Polychaeta) from South America and Antarctica collected chiefly during the cruises of the R/V Anton Bruun, R/V Hero and USNS Eltanin. *Proceedings of the Biological Society of Washington*, 94, 1131–1162.
- Blake, J.A. (2000) Family Scalibregmatidae Malmgren, 1867. In: Blake, J.A., Hilbig, B. & Scott, P.H. (Eds.), *Taxonomic Atlas of the Benthic Fauna of the Santa Maria Basin and the Western Santa Barbara Channel*. Santa Barbara Museum of Natural History, Santa Barbara, California, pp. 129–144.
- Brattegard, T. & Fosså, J.H. (1991) Replicability of an epibenthic sampler. *Journal of the Marine Biological Association of the United Kingdom*, 71, 153–166.
<http://dx.doi.org/10.1017/s0025315400037462>
- Furreg, E. (1925) Zur Systematik der Polychätenfamilie Scalibregmatidae. *Zoologische Jahrbücher, Abteilung für Systematik, Geographie und Biologie der Tiere*, 50, 123–190.
- Hansen, G.A. (1879) Annelider fra den norske Nordhavsexpedition i 1876. *Nyt Magazin for Naturvidenskaberne*, 24, 1–17.
- Hansen, G.A. (1882) Annelida. In: *The Norwegian North-Atlantic Expedition 1876-1878*. Grøndahl & Søn, Christiania, pp. 1–53.
- Hartman, O. (1965) Deep-water benthic polychaetous annelids off New England to Bermuda and other North Atlantic areas. *Occasional Papers of the Allan Hancock Foundation*, 28, 1–378.
- Hartman, O. (1967) Polychaetous annelids collected by the USNS Eltanin and Staten Island cruises, chiefly from Antarctic Seas. *Allan Hancock Monographs in Marine Biology*, 2, 1–387.
- Imajima, M. (2009) Deep-sea Benthic Polychaetes off Pacific Coast of the Northern Honshu, Japan. *National Museum of Nature and Science Monographs*, 39–192.
- Jirkov, I.A. (2001) *Polychaeta of the Arctic Ocean*. Yanus, Moskva, 632 pp.
- Kongsrud, J.A., Bakken, T. & Oug, E. (2011) Deep-water species of the genus *Ophelina* (Annelida, Opheliidae) in the Nordic Seas, with the description of *Ophelina brattegardii* sp. nov. *Italian Journal of Zoology*, 78, 95–111.
<http://dx.doi.org/10.1080/11250003.2011.606658>

- Kudenov, J.D. & Blake, J.A. (1978) A review of the genera and species of the Scalibregmidae (Polychaeta) with description of one new genus and three new species from Australia. *Journal of Natural History*, 12, 427–444.
<http://dx.doi.org/10.1080/00222937800770291>
- Mackie, A.S.Y. (1991) *Scalibregma celticum* new species (Polychaeta, Scalibregmatidae) from Europe, with a redescription of *Scalibregma inflatum* Rathke, 1843 and comments on the genus *Sclerobregma* Hartman, 1965. *Bulletin of Marine Science*, 48, 268–276.
- Oug, E. (2000) The marine benthic fauna in the region of Tromsø, northern Norway, with particular reference to bristle worms (Annelida: Polychaeta). Dr. thesis. University of Tromsø, Tromsø, 160 pp.
- Persson, J. & Pleijel, F. (2005) On the phylogenetic relationships of *Axiokebuita*, *Travisia* and Scalibregmatidae (Polychaeta). *Zootaxa*, 998, 1–14.
- Rathke, H. (1843) Beiträge zur Fauna Norwegens. *Verhandlungen Kaiserlichen Leopoldinisch-Carolinischen Akademie Naturforscher, Breslau*, 20, 1–264.
<http://dx.doi.org/10.5962/bhl.title.11613>
- Sars, G.O. (1872) Diagnoser af nye Annelider fra Christianiafjorden, efter Professor M. Sars' efterladte Manuskripter. *Forhandlinger fra Videnskabs-Selskabet i Christiania*, 1871, 406–417.
- Sars, M. (1846) *Fauna littoralis Norvegiae I. Oder Beschreibung und Abbildungen neuer oder wenig bekannten Seethiere, nebst Beobachtungen über die Organisation, Lebensweise und Entwicklung derselben*. Johann Dahl, Christiania, 194 pp.
- Schüller, M. (2008) New polychaete species collected during the expeditions ANDEEP I, II, and III to the deep Atlantic sector of the Southern Ocean in the austral summers 2002 and 2005 - Ampharetidae, Opheliidae, and Scalibregmatidae. *Zootaxa*, 1705, 51–68.
- Snæli, J.-A. (1998) A simple benthic sledge for shallow and deep-sea sampling. *Sarsia*, 83, 69–72.
- Støp-Bowitz, C. (1945) Les Scalibregmiens de Norvège. *Nytt Magazin for Naturvidenskapene*, 85, 63–87.
- Støp-Bowitz, C. (1948) Sur les polychètes arctiques des familles des Glycériens, des Ophéliens, des Scalibregmiens et des Flabelligériens. *Tromsø Museums Årshefter*, 66, 1–58.
- Théel, H. (1879) Les annélides polychètes des mers de la Nouvelle-Zemble. *Kongliga Svenska Vetenskaps-akademiens Handlingar*, 16, 1–75.
- Zachs, I. (1925) Nouvelles additions a la faune des Polychaeta du Murman. *Comptes Rendus de l'Académie des Sciences de SSSR, Leningrad*, 1925, 1–3.